

## Acid Deposition

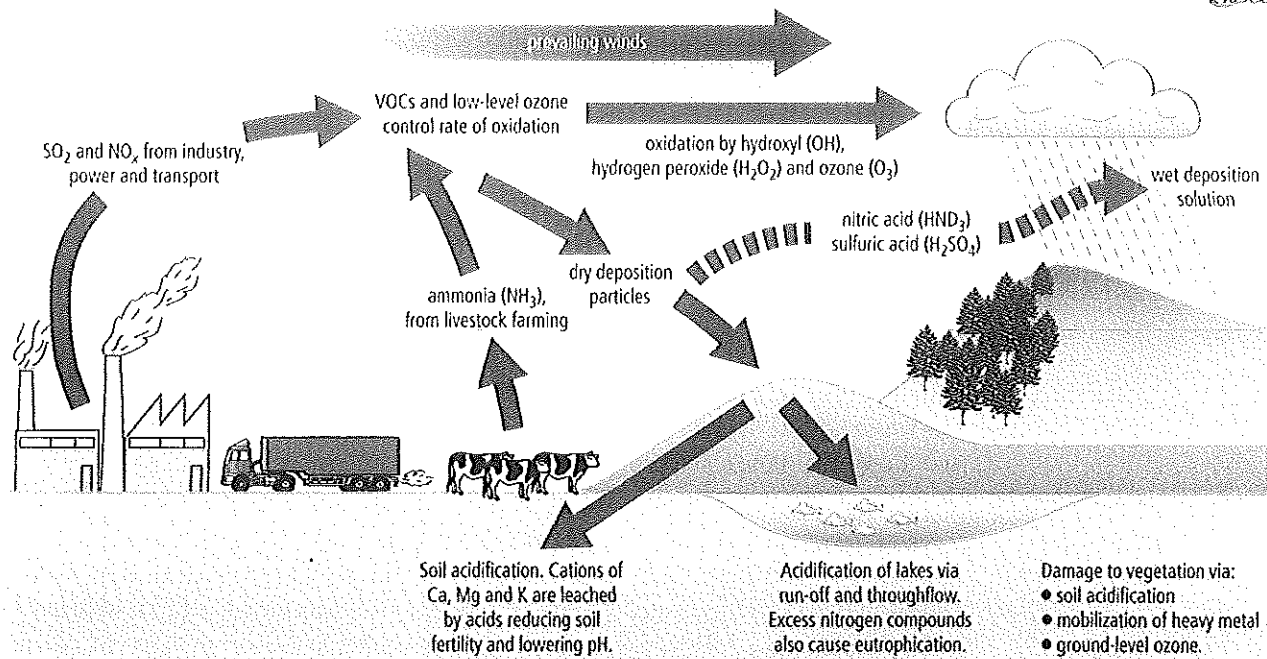


WATER has a pH of 7

### 5.8.1 Outline the chemistry leading to the formation of acidified precipitation.

\* Normal, unpolluted rain, has a pH of 5.6  
 ↳ Caused by  $\text{CO}_2$  in the atmosphere.

\* Precipitation w/ a pH below 5.6 is considered acidic. → can go below 2 pH



What is acid precipitation?

acid coming down from the sky.

- wet → Rain or Snow
- dry → gas or dry particulates

Main Pollutants & Sources

Primary Pollutants - pollutants emitted directly

$\text{SO}_x$  &  $\text{NO}$  or  $\text{NO}_2$   
 (Combustion of fossil fuels)

- $\text{SO}_x$  comes from burning coal/oil
- $\text{NO}_x$  comes from a reaction btw.  $\text{O}_2$  &  $\text{N}_2$  in the atmosphere during high heat of combustion.

Can react to form

Secondary Pollutants

$\text{SO}_3$ ,  $\text{H}_2\text{SO}_3$ ,  $\text{H}_2\text{SO}_4$   
 $\text{HNO}_3$

\* pH: each # on the pH scale is 10x different.  
 for example  
 6 is 10x stronger than 7

### 5.8.2 Describe three possible effects of acid deposition on soil, water, and living organisms

- Soil**
- Acid deposition reduces soil particles ability to hold on to nutrients.
  - Also inhibit nitrogen-fixing bacteria

- Water**
- Acidified lakes are:
    - fewer species / ↓ Biodiversity
    - ↑ visibility
    - white moss spreading across bottom of a lake.
    - ↑ levels of dissolved metals (cadmium, copper, aluminum, zinc, & lead)
      - ↳ metals are easier for plants to get
- BOGS - when acidified release more methane (a greenhouse gas)

- LIVING ORGANISMS**
- LICHENS → used as a Bioindicator for acid rain. "indicator species"
  - Fish & Aquatic Organisms → Aluminum Released into waterways  
↓  
fish can't regulate salt & water in its body. → inhibits intake of  $O_2$  & NaCl  
Mercury is also easier to dissolve → more in fish → Biomagnification.
  - Trees & Forests → Breaks down lipids in foliage & damages the membranes → plant death  
→ interferes with photosynthesis  
\* Coniferous Trees lose their needles too quickly.
    - Young trees grow too quickly & don't develop properly - wood is too soft.

5.8.3 Explain why the effect of acid deposition is regional rather than global.

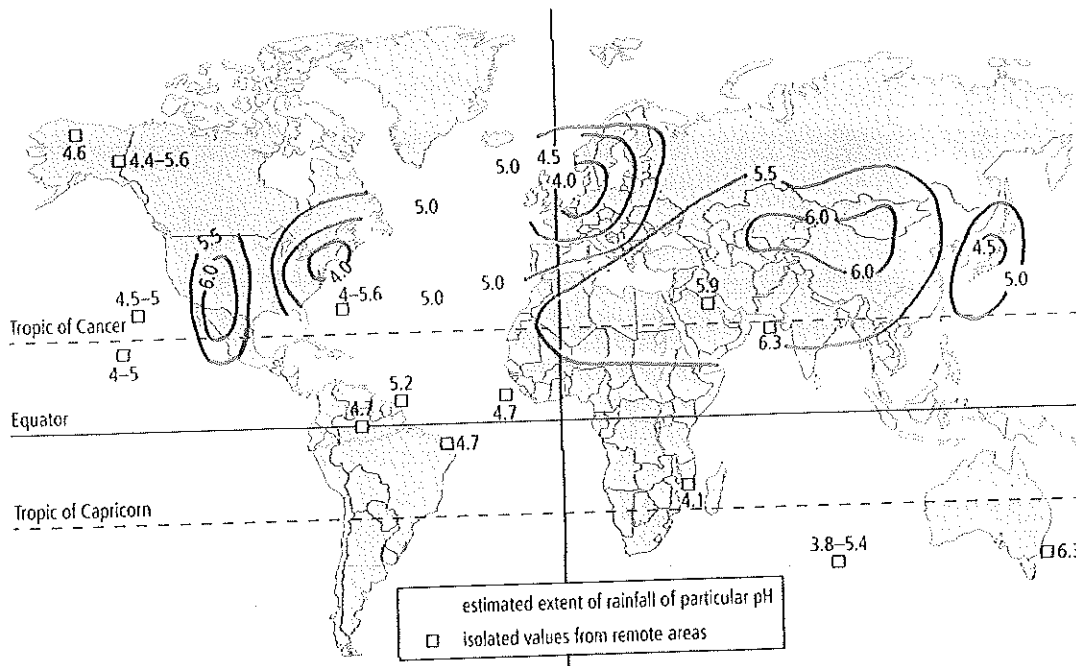
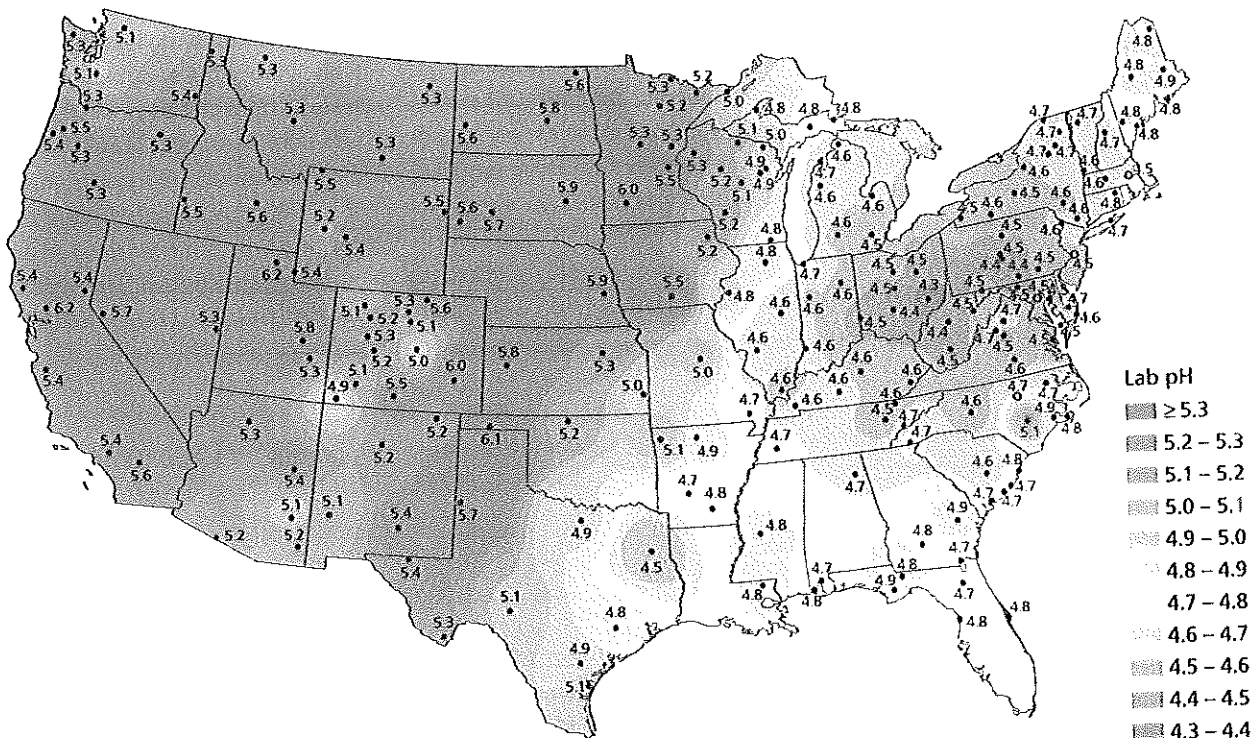


Figure 5.15  
Global locations  
of acidified  
deposition.

- areas of industrialization
- downwind from fossil fuel pow. plants.
- upland areas w/ high rainfall
- lots of forests, streams & lakes
- thin soils



Acid deposition Regional (compared to global warming & hole in the Ozone)

↑  
Why? Before pollution can spread over long distances, Comes back to land.

→ Normally, downwind from industrial areas.

→ impacts local waterways → impact fish that migrate further a field.

5.8.4 Describe and evaluate pollution management strategies for acid deposition.

Alter human activity

- \* expensive
- \* economy based on fossil fuels

- burn less fossil fuels (dif. technology)
- ↑ Public transport
- ↓ private cars
- switch to low sulfur fuel
- Remove sulfur before combustion
- Reduce sulfur oxides after combustion
- Allow decomposition of plants to return nutrients to soil + offset acidification process

Regulate & Reduce Pollutants

- \* expensive → passed onto consumers
- \* Converters are expensive & must be maintained

- Wet scrubbing - use sorbents (like limestone) to absorb  $\text{SO}_2$
- Spray dry scrubbing - use lime to form a mix of calcium sulfate/sulfite
- etc.
- Legislation
  - US - Clean Air Act
  - Convention on Long-Range Transboundary Air Pollution
    - Brought together polluter & pollution
    - Set clean targets
    - made polluters see responsibility

Clean up & Restore

- \* must be repeated often
- \* affects Biodiversity in other ways
- \* Treats symptoms Not Causes
- \* difficult to monitor agreements

- Lime forest plantations

an average of 50% reduction in Europe. LEDC's developing quickly & using old/dirty technology. Hard to have international agreements